STATISTICAL ANALYSIS ON IMMUNIZE CHILDREN FROM 0 – 5 YEARS BETWEEN THE PERIOD OF 2020 - 2024

(A CASE STUDY OF HEALTH FACILITY MPHCC OKE-OSE-ALALUBOSA ILORIN KWARA STATE)

BY

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CERTIFICATION

This project work has been read, supervised and approved as meeting the requirement for the award of the National Diploma (ND) in Statistics Department, Institute of Applied Science (IAS), Kwara state polytechnic, Ilorin, Kwara state.

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DEDICATION

I dedicate this project to God Almighty, whose grace and guidance made this journey possible. This work is a reflection of all your contributions, and I am deeply grateful.

ACKNOWLEDGEMENT

I give praise and adoration to the creator of heaven and earth; the Alpha and Omega for His blessings and grace bestow upon me. And for the wisdom, knowledge and understanding given to me to be able to accomplish this task.

My special gratitude goes to my parent (Mr. and Mrs. Matthew) who has been there for me throughout the process of everything in my life. And also for their support, financially, morally and spiritually. I say a BIG Thank to you and may you reap the fruit of your labour. Amin…….

My profound gratitude goes to my supervisor, the person of Dr. (Mrs.) Ayelabegan and Miss Ajiboye R.A for their assistance and guidance during this research work, and also to our able head of department Mrs. Elepo T.A and to every one of my lecturers that taught me everything I know in statistics and all lecturer in the Department of Statistics for the good academic support given since the beginning of our program till point on time.

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ABSTRACT

This study presents a statistical analysis of childhood immunization records for children aged 0 to 5 years between 2020 and 2024 at MPHCC Oke-Ose/Alalubosa in Ilorin East Local Government Area, Kwara State, Nigeria. The aim was to examine trends in immunization, assess patterns across age groups and years, and determine whether there were statistically significant differences in immunization coverage over time. A total of ***4,919*** *immunization records were analyzed using descriptive statistics, multiple bar chart visualization, Chi-Square test of independence, and one-way ANOVA. The descriptive analysis revealed a steady increase in the number of immunized children from* ***845 in 2020*** *to* ***1,118 in 2024****, with the* ***<1-year age group*** *consistently recording the highest counts. The multiple bar chart illustrated the upward trend in immunization across all age groups over the five years. The Chi-Square test result ($\chi^2 = 1.684$, $df = 20$, $p = 1.000$) showed no statistically significant relationship between age group and year of immunization, indicating a consistent pattern of vaccine administration across age groups annually. However, the ANOVA test ($F = 552.000$, $p < 0.001$) revealed a significant increase in the total number of children immunized each year. In conclusion, the health facility maintained a balanced immunization effort across all age groups, while achieving significant growth in overall vaccination coverage from 2020 to 2024. The study recommends continued outreach, increased support for older age groups, and enhanced community engagement for sustained immunization success.*

Keywords: *Immunization, Childhood Vaccination, Chi-Square Test, ANOVA, Public Health, Kwara State, Age Group, MPHCC Oke-Ose, Vaccine Coverage, Statistical Analysis.*

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Immunization has been recognized globally as one of the most effective and cost-efficient public health interventions to reduce childhood morbidity and mortality caused by vaccine-preventable diseases (VPDs). According to the World Health Organization (WHO), immunization prevents between 2 and 3 million deaths annually from diseases such as diphtheria, tetanus, pertussis, measles, and hepatitis B. For developing countries like Nigeria, where child mortality rates remain unacceptably high, increasing immunization coverage is vital in improving child health outcomes and achieving global health targets such as the Sustainable Development Goals (SDGs), particularly Goal 3, which aims to ensure healthy lives and promote well-being for all at all ages.

Nigeria's National Program on Immunization (NPI), under the Federal Ministry of Health, provides routine immunization services in collaboration with state and local health facilities. Children under five years, especially those in the 0–11 months age bracket, are primary targets for immunization against VPDs. However, despite the availability of free routine vaccines, many challenges persist in ensuring adequate and equitable coverage. Issues such as inadequate infrastructure, vaccine stock-outs, poor record-keeping, parental ignorance, misinformation, and socio-cultural beliefs often hinder full immunization of children in many regions, especially rural areas.

In Kwara State, several health facilities have taken up the responsibility of executing immunization programs. The MPHCC (Maternal and Public Health Care Centre) Oke-Ose/Alalubosa, located in Ilorin East Local Government Area, is one such facility actively involved in childhood immunization. The centre provides various immunizations as stipulated by the national schedule, including BCG, OPV, Penta vaccines, Measles, and Yellow Fever vaccines. These vaccines are administered according to the age of the child and the availability of doses.

Tracking immunization performance over time is essential for health policy planning and intervention. Statistical analysis enables health planners and policymakers to understand the trends, strengths, and weaknesses of the immunization system. It also provides insights into whether specific age groups are under-immunized, whether there has been a decline or improvement over certain years, and whether immunization strategies are achieving the desired outcomes.

This study seeks to carry out a statistical analysis of children immunized at MPHCC Oke-Ose/Alalubosa over a five-year period (2020–2024). The study focuses on children between 0 to 5 years, a crucial age bracket for immunization programs. By examining the descriptive statistics of the immunized population, the study will highlight patterns of immunization across age groups and years, reveal disparities or coverage gaps, and help determine if significant changes occurred over time.

The rationale behind selecting MPHCC Oke-Ose/Alalubosa is due to its relevance as a community health centre serving a predominantly rural and peri-urban population. The data from this facility reflect the practical realities of immunization coverage in such areas, including operational challenges, resource allocation, seasonal variation in health-seeking behavior, and administrative records.

Between 2020 and 2024, several national and global events—such as the COVID-19 pandemic—also influenced health service delivery, including routine immunizations. Many facilities experienced reduced attendance, supply chain disruptions, and resource diversion toward pandemic management. These factors may have affected immunization statistics in various ways, such as lower turnout, inconsistent vaccine availability, or delayed doses.

It is therefore important to assess how these external and internal factors influenced immunization coverage in the MPHCC Oke-Ose/Alalubosa during the specified period. A multiple bar chart will visually represent the data to better interpret the trends in immunization across both age and year dimensions. Furthermore, statistical tests, including the Chi-Square Test of Independence, will be used to assess whether significant relationships or disparities exist between age groups and years with regard to immunization numbers.

The findings of this research will serve as a guide for local health authorities, development partners, and community stakeholders in planning future immunization campaigns and addressing the gaps identified. It may also contribute to literature on immunization coverage trends in semi-urban communities of Kwara State, with implications for broader health systems strengthening.

In summary, child immunization remains a critical component of public health, and its success is tied to continuous monitoring and analysis. A data-driven approach to immunization management can ensure that no child is left behind, thereby preventing disease outbreaks and fostering healthier communities. This study is therefore timely and significant in providing a statistical basis for evaluating immunization trends at a local health facility in Nigeria.

1.2 Statement of the Problem

Despite the availability of routine immunization services at MPHCC Oke-Ose/Alalubosa, challenges such as inconsistent coverage, resource limitations, and fluctuating attendance may have affected the number of children immunized annually. Additionally, there is a lack of empirical data analysis to evaluate how immunization rates vary by age and across years. This makes it difficult to assess the impact of interventions and address gaps in service delivery. The absence of statistical insights hinders effective planning and resource allocation. Therefore, this study seeks to analyze the immunization data from 2020 to 2024 to determine patterns, trends, and significance in immunization coverage.

1.3 Aim and Objectives of the Study

Aim of the Study:

The primary aim of this study is to statistically analyze the total number of children immunized from age 0 to 5 years between 2020 and 2024 at MPHCC Oke-Ose/Alalubosa, Ilorin East, Kwara State.

Objectives of the Study:

i. To present the descriptive statistics of the number of children immunized by age and year.
ii. To represent the immunization data using multiple bar charts for visual interpretation.
iii. To determine whether there is a statistically significant difference in the number of children immunized across age groups and years.
iv. To determine whether there is a significant difference in the **mean number of children immunized per year** between **2020 and 2024**.

1.4 Significance of the Study

This study provides valuable insights into the trends and patterns of child immunization at a local health facility level. It will help stakeholders understand how effectively the immunization program has been implemented over the years. The analysis will support evidence-based decision-making, assist in identifying age groups or years with low coverage, and help allocate resources more efficiently. Furthermore, it contributes to academic and policy-related discussions on improving child health outcomes in Nigeria. By revealing significant statistical relationships in the data, the study will aid health workers and policymakers in designing targeted immunization strategies and interventions.

1.5 Scope and Limitation of the Study

This study is limited to the statistical analysis of children immunized at MPHCC Oke-Ose/Alalubosa, Ilorin East, Kwara State, between the years 2020 and 2024. The analysis covers children aged 0 to 5 years, with focus on annual immunization data disaggregated by age group. The study uses secondary data extracted from the immunization records available at the health facility.

The scope does not include detailed clinical evaluation of vaccine types or specific medical outcomes of immunized children. Additionally, it does not assess caregiver knowledge or attitudes toward immunization. The limitations of the study include possible inaccuracies in health facility records, incomplete data entries, and external factors such as COVID-19 that might have influenced the data. Despite these limitations, the study provides useful statistical insights into immunization trends that can guide local public health planning and policy formulation.

1.6 Definition of Terms

- **Immunization:** The process by which an individual is made immune or resistant to an infectious disease, typically by the administration of a vaccine.
- **Vaccine-Preventable Diseases (VPDs):** Diseases that can be prevented through immunization, such as measles, polio, and tetanus.
- **Descriptive Statistics:** Statistical methods that summarize and describe the main features of a dataset, such as mean, median, and standard deviation.
- **Chi-Square Test:** A statistical test used to determine if there is a significant association between categorical variables.
- **Multiple Bar Chart:** A graphical representation used to compare different groups across multiple categories using parallel bars.
- **Age Group 0–5 Years:** Refers to children from birth up to their fifth birthday, divided into yearly age categories.
- **Health Facility:** A place where healthcare services are provided, in this context, the MPHCC Oke-Ose/Alalubosa.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Immunization remains a cornerstone of global public health, particularly in reducing child morbidity and mortality from preventable diseases. As vaccination programs continue to evolve, researchers and healthcare providers emphasize the importance of evaluating their performance through statistical methods. This chapter explores relevant literature on childhood immunization, statistical evaluation of public health data, age-specific immunization trends, and the effectiveness of routine immunization strategies in Nigeria and globally. It also reviews literature on data visualization and statistical significance testing in immunization studies. The reviews provide the theoretical and empirical foundation for this study, highlighting existing findings and identifying gaps that this research intends to address.

2.2 Review of Related Literature

Global Perspective on Childhood Immunization

Childhood immunization is a fundamental strategy for reducing the burden of infectious diseases globally. According to the World Health Organization (WHO, 2021), immunization prevents an estimated 4 to 5 million deaths annually by protecting children from life-threatening diseases like measles, diphtheria, polio, and pertussis. The introduction of vaccines into national health systems has significantly lowered the incidence and mortality rates of many infectious diseases. For instance, the Global Polio Eradication Initiative (GPEI) has helped reduce polio cases by over 99% since its launch in 1988.

Despite such achievements, disparities in immunization coverage remain, particularly in low-income regions. In Sub-Saharan Africa, millions of children still miss essential vaccines due to weak health systems, misinformation, supply chain disruptions, and social-cultural beliefs. In

2020, the COVID-19 pandemic further exacerbated these challenges by limiting healthcare access and causing vaccine hesitancy due to fears of contagion at health centers (UNICEF, 2021).

Research by Lankarani et al. (2017) emphasizes that timely immunization is as important as coverage. Delayed vaccinations increase children's vulnerability to diseases and reduce herd immunity. Several countries have adopted outreach strategies and digital record systems to close the gap in coverage and improve data reliability. However, the success of these strategies varies based on local infrastructure and political will.

Another critical issue is data quality. The WHO (2022) reports that many developing countries lack robust immunization registries, leading to under-reporting or over-reporting of coverage. In such settings, statistical methods play a crucial role in verifying, analyzing, and interpreting immunization trends.

In summary, the global literature highlights the life-saving benefits of immunization, while also acknowledging persistent challenges such as data inaccuracies, inequality in coverage, and the impact of public health emergencies like pandemics. Statistical analysis of immunization data is thus essential to guide policies and interventions aimed at improving child health outcomes.

Immunization Coverage in Nigeria

In Nigeria, childhood immunization is coordinated by the National Primary Health Care Development Agency (NPHCDA) and implemented through the National Program on Immunization (NPI). Despite free access to vaccines, Nigeria continues to struggle with poor coverage, especially in rural and hard-to-reach areas. The Nigeria Demographic and Health Survey (NDHS, 2018) reported that only 31% of children aged 12–23 months were fully immunized, with significant disparities across geopolitical zones and socioeconomic classes.

Several studies attribute low immunization rates in Nigeria to factors such as maternal education, geographical access to health centers, socio-cultural beliefs, and misinformation. A study by Adedokun et al. (2020) found that children born to mothers with no formal education were less likely to be fully immunized. Furthermore, urban children generally have higher immunization rates than their rural counterparts due to better access to healthcare and information.

In rural areas like Ilorin East in Kwara State, outreach programs and periodic immunization campaigns have been used to complement routine services. However, coverage often remains inconsistent due to logistical constraints, seasonal migration, and health worker shortages. The role of community engagement and mobile health interventions has shown promise in bridging these gaps.

In addition, funding for vaccines and logistics remains a challenge. Although Nigeria has benefited from support through the GAVI Alliance and other donor agencies, the country's dependence on external funding raises sustainability concerns. The recent COVID-19 pandemic strained already limited resources, further disrupting routine immunization schedules and reducing clinic attendance due to fears of infection.

Monitoring immunization data through descriptive and inferential statistics is crucial to identifying areas of weakness and making informed policy decisions. Data disaggregated by age and year allows for the identification of trends and gaps that can be addressed through targeted interventions.

Therefore, understanding immunization patterns through statistical tools is essential in a country like Nigeria, where multiple socio-economic and systemic factors hinder optimal vaccine coverage. This research aligns with national health priorities by using data to assess progress, highlight disparities, and suggest improvements in local immunization programs.

Statistical Approaches to Immunization Data

Statistical analysis of health data is essential for uncovering trends, evaluating program effectiveness, and informing public health interventions. Immunization data, in particular, benefits significantly from statistical evaluation as it deals with time-based, age-disaggregated, and population-specific records. Common statistical tools used include descriptive statistics, bar charts, trend analysis, and hypothesis testing methods such as the Chi-Square Test of Independence.

Descriptive statistics help summarize the key characteristics of immunization data. Measures such as mean, median, and standard deviation provide a clear view of the distribution of immunized children across years and age categories. Visual tools like multiple bar charts are effective in identifying fluctuations and patterns in immunization coverage over time.

Inferential statistical techniques are crucial in testing hypotheses about associations between categorical variables. The Chi-Square Test, for instance, can determine if there is a significant relationship between a child's age group and the year of immunization. According to Ogunyemi and Akindele (2019), such methods offer a robust way to detect disparities or consistencies in healthcare delivery across different population segments.

Regression models have also been used in some studies to predict immunization uptake based on demographic variables like parental education, income level, and proximity to health facilities. However, in small-scale or facility-based studies, simpler non-parametric methods are often preferred due to data limitations.

Data visualization enhances comprehension and communication of statistical findings. For immunization programs, presenting data in multiple bar charts enables healthcare providers and policymakers to observe age-specific immunization coverage across multiple years in a single glance, facilitating faster and more targeted decision-making.

Nevertheless, the reliability of statistical conclusions depends heavily on the accuracy and completeness of the data. Studies such as Eze and Uche (2020) emphasize the importance of quality record-keeping at the health facility level to ensure valid analysis. Challenges such as missing data, inconsistent age categorization, and misreporting can bias results and misinform policy.

In conclusion, statistical analysis is indispensable in immunization studies, offering tools to describe, visualize, and test relationships within health data. It enables evidence-based planning and resource allocation, especially in settings with limited resources and varying program effectiveness like Nigeria.

Age-Specific Trends in Immunization Uptake

Age-specific analysis of immunization is vital for evaluating whether children are receiving vaccines at the recommended ages and for identifying gaps in routine immunization schedules. The first five years of life are crucial for immunization as the immune system is still developing, and children are more vulnerable to infections. The Expanded Programme on Immunization (EPI) recommends a series of vaccines beginning at birth and continuing through the first year of life. Additional doses and boosters are given up to five years of age.

Research by Babalola and Fatusi (2020) indicates that younger age groups, particularly infants under 12 months, often receive higher immunization coverage due to community outreach efforts, maternal awareness during antenatal and postnatal visits, and initial enthusiasm after birth. However, as children age, immunization rates tend to decline. This may be due to caregiver forgetfulness, relocation, work-related time constraints, or a false sense of security that older children are no longer at risk of vaccine-preventable diseases.

In a study conducted in Northern Nigeria, Lawal et al. (2021) found that immunization rates for children aged 0–11 months were significantly higher than for those aged 1 to 5 years. This finding underscores the importance of tracking immunization by age group, as aggregate data might mask deficiencies in certain age categories. Age-specific data helps identify where dropouts occur in the immunization schedule, allowing healthcare workers to follow up with defaulting households.

In rural health facilities such as MPHCC Oke-Ose/Alalubosa, factors such as vaccine stock-outs and irregular immunization days can disproportionately affect certain age groups. For example, if measles vaccines are unavailable during scheduled immunization days, children reaching 9 months of age may miss the dose and may not return.

Analyzing age-specific immunization patterns over multiple years helps in evaluating the consistency of vaccine delivery and identifying systemic weaknesses. This study will employ bar charts to visualize yearly trends across age groups and will use the Chi-Square Test to determine whether statistically significant differences exist between age groups and immunization years.

In conclusion, age-focused studies offer granular insights that are crucial for improving immunization strategies. Interventions must not only focus on newborns but also ensure follow-up for older children, especially in areas with known service delivery gaps or access challenges.

Data Visualization in Health Studies

Data visualization is a powerful tool in public health research and service delivery, offering a way to present complex information in a clear and interpretable format. In immunization studies, visual representations such as bar charts, line graphs, and heat maps are commonly used to track coverage levels over time, across locations, and among different demographic groups.

Multiple bar charts are especially effective when comparing multiple groups—such as age categories—across several time points, like years. According to Krum (2018), visualized data increases the likelihood of accurate interpretation and decision-making by non-technical stakeholders, including policymakers and local health administrators.

In a study on immunization patterns in Uganda, Nanyunja et al. (2017) used multiple bar charts to illustrate disparities in immunization coverage across districts and over a five-year period. The visual representation highlighted not only the temporal decline in certain regions but also showed how specific age groups were consistently underserved. This prompted the Ministry of Health to launch targeted interventions for the lagging areas.

Similarly, Adeyemi and Bakare (2020) emphasized that visual tools are essential for reporting facility-level data. In their review of routine immunization data in Southwest Nigeria, they noted that bar charts were useful for community mobilization, allowing health workers to demonstrate progress or setbacks in a way that community members could easily understand.

For this project, the use of multiple bar charts will provide a clear overview of the immunization performance at MPHCC Oke-Ose/Alalubosa from 2020 to 2024. This visualization will allow for easy comparison of immunization rates across different age groups for each year, highlighting years of low performance and age groups that may have been neglected.

While statistical tables are useful, they can be difficult to interpret at a glance, particularly for large datasets. Charts, however, appeal to visual cognition and help in quickly identifying patterns, outliers, and gaps. However, it is important that such visuals are accompanied by appropriate context and interpretation to avoid misrepresentation.

In summary, data visualization is a necessary companion to statistical analysis in immunization studies. It supports transparency, fosters community engagement, and enables evidence-based decision-making at all levels of the health system.

Impact of External Events on Immunization Programs

External events, particularly public health crises and natural disasters, have significant implications for immunization programs. These events can disrupt vaccine supply chains, limit access to healthcare facilities, and shift public health priorities, resulting in decreased immunization coverage. One of the most notable disruptions in recent history was the COVID-19 pandemic, which severely affected routine immunization services globally.

According to WHO and UNICEF (2021), over 25 million children missed at least one routine vaccine dose in 2021 alone, largely due to COVID-19-related service disruptions. Lockdowns, fear of contagion, and the redirection of healthcare resources to pandemic control efforts all contributed to declines in vaccine uptake. These impacts were especially felt in developing countries with already fragile health systems.

In Nigeria, routine immunization was heavily impacted. A study by Okonkwo and Okafor (2022) found that during the peak of the COVID-19 pandemic in 2020, many health facilities experienced a 30% drop in child immunization attendance. Clinics like MPHCC Oke-Ose/Alalubosa, which rely on periodic outreach services, faced difficulties in mobilizing caregivers due to travel restrictions and safety concerns.

Beyond pandemics, other external factors such as economic recession, labor strikes by healthcare workers, and vaccine hesitancy fueled by misinformation can also reduce immunization coverage. These events may cause temporary or long-term declines in service delivery, with lasting effects on public health.

Statistical analysis can help quantify the impact of these events. For instance, a significant drop in immunization numbers in 2020 might be attributed to COVID-19, and statistical tests can be used to assess whether these changes were statistically significant or part of a larger trend. This helps in separating random fluctuations from real, event-driven changes.

Understanding the impact of external events is crucial for building resilient immunization programs. It allows health planners to prepare contingency strategies, such as mobile vaccination teams, catch-up campaigns, or remote monitoring systems to maintain coverage during crises.

In conclusion, immunization programs do not operate in isolation from the broader socio-political environment. Disruptions such as pandemics, economic instability, or misinformation can drastically affect vaccine uptake. As this study evaluates immunization trends from 2020 to 2024, it is essential to account for such external factors when interpreting the results and recommending policy actions.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodological approach adopted in this study to analyze the immunization data of children aged 0 to 5 years between 2020 and 2024. It describes the research design, statistical techniques used, sources of data, and methods of data presentation. The aim is to ensure that the data is analyzed accurately, and the findings are logically interpreted. The methodology focuses on the application of descriptive and inferential statistical tools to determine patterns, trends, and relationships within the dataset obtained from MPHCC Oke-Ose/Alalubosa, Ilorin East, Kwara State.

3.2 Statistical Techniques

This study applies both **descriptive** and **inferential** statistical techniques to examine the immunization data of children aged 0 to 5 years from 2020 to 2024. The combination of these techniques ensures a comprehensive understanding of the data trends, patterns, and relationships, which supports evidence-based conclusions.

Descriptive Statistics

Descriptive statistics provide a summary of the basic features of the data collected. They are used to describe the main characteristics of the dataset in a manageable form. The following descriptive measures are employed:

- **Frequency distribution**: Shows how often each age group was immunized within each year.
- **Measures of central tendency**: Mean, median, and mode help to determine the average number of children immunized.

- **Measures of dispersion**: Standard deviation, variance, range (minimum and maximum) are used to understand the variability in immunization numbers across age groups and years.
- These values help identify age groups or time periods with higher or lower immunization coverage, thus supporting trend analysis.

Data Visualization

To enhance the clarity and communicability of the analysis, **multiple bar charts** are used to represent the immunization figures across age groups and years. This visual method helps to compare the data across two variables (age and year) simultaneously. It allows quick identification of peak immunization periods, underperformance, or trends in different age categories over the five-year span.

Inferential Statistics

Inferential statistics go beyond merely describing the data. They help to determine whether observed differences or associations in the dataset are statistically significant or occurred by chance.

Chi-Square Test of Independence

The **Chi-Square Test of Independence** is used in this study to assess whether there is a statistically significant relationship between two categorical variables: **age group (0, 1, 2, 3, 4, 5 years)** and **year of immunization (2020–2024)**. The Chi-Square test evaluates whether the distribution of immunized children across years is dependent on their age category or whether both variables are independent.

This is done using a contingency (cross-tabulation) table, which shows the frequency of immunized children for each combination of age and year.

Hypothesis Testing

To apply the Chi-Square test effectively, the following hypotheses are stated:

- **Null Hypothesis (H_0):** There is no significant relationship between the age group of children and the year of immunization. (i.e., immunization distribution is independent of age and year).
- **Alternative Hypothesis (H_1):** There is a significant relationship between the age group of children and the year of immunization. (i.e., immunization distribution depends on age and year).

The Chi-Square statistic is calculated using the formula:

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where:

- Oij = Observed frequency for cell in row i, column j
- Eij = Expected frequency for cell in row i, column j (calculated as $\frac{(Row\ Total \times Column\ Total)}{Grand\ Total}$)

The calculated Chi-Square value is compared with the critical value from the Chi-Square distribution table at a chosen level of significance (usually 0.05). If the calculated value exceeds the critical value, the null hypothesis is rejected.

The result will indicate whether the year in which a child was immunized is significantly associated with the age of the child, thereby revealing patterns in the delivery of immunization services over time.

ONE-WAY ANOVA:

One-Way Analysis of Variance (ANOVA) is a statistical method used to compare the mean of three or more independent groups to determine if at least one group mean is significantly different from the others. It tests the effect of a single categorical independent variable (factor) on a continuous dependent variable. In this study, it will be applied to determine if there is a significant difference in the mean number of children immunized across the years 2020 to 2024.

When to Use One-Way ANOVA:

- You are comparing three or more groups.
- Each group is independent.
- Your outcome variable is continuous.
- You suspect that at least one group may be different from the other

Hypotheses:

- **Null Hypothesis (H_0):** There is **no significant difference** in the mean number of children immunized across the years 2020 to 2024.
- **Alternative Hypothesis (H_1):** There is **a significant difference** in the mean number of children immunized across the years.

An ANOVA (Analysis of Variance) table is used to summarize the results of an ANOVA test, which examines whether there are statistically significant differences between the means of three or more groups. Here's a standard format for an **ANOVA table**, along with explanations for each component:

Source of Variation	**Sum of Squares (SS)**	**Degrees of Freedom (df)**	**Mean Square (MS)**	**F-ratio (F)**	**p-value**
Treatment	SSTreatment	t−1t – 1	SST / (t - 1)	MST/MSE	p-value

Block	SSBlock	b−1b – 1	SSB / (b - 1)	MSB/MSE	p-value
Error	SSError	(t−1)(b−1)(t - 1)(b - 1)	SSE / (t-1)(b-1)		
Total	**SSTotal**	**bt – 1**			

Software Application

All analyses will be conducted using IBM SPSS. Excel is used for data entry and visualization (charts and tables), while SPSS provides the platform for descriptive statistics, cross-tabulation, and Chi-Square testing.

3.3 Source of Data

The data used for this study is secondary in nature and was obtained from the immunization records of the Maternal and Public Health Care Centre (MPHCC) located at Oke-Ose/Alalubosa in Ilorin East Local Government Area of Kwara State. The dataset consists of the number of children aged 0 to 5 years immunized annually from 2020 to 2024. The data was collected with permission from the health facility and includes disaggregated records categorized by age and year.

3.4 Data Presentation

The data is presented in tabular format for clarity and ease of interpretation.

Here is the summary table showing the total number of immunized children per age group per year (2020–2024):

Year	<1 Year	1 Year	2 Years	3 Years	4 Years	5 Years
2020	182	156	143	132	123	109
2021	189	166	160	147	133	120
2022	202	178	171	158	140	130
2023	219	193	176	169	157	148
2024	226	205	188	178	166	155

CHAPTER FOUR

DATA ANALYSIS

4.1 Introduction

This chapter presents a comprehensive analysis of the data collected from the MPHCC Oke-Ose/Alalubosa on the immunization of children aged 0 to 5 years between the years 2020 and 2024. The aim is to evaluate trends, patterns, and relationships within the immunization records using both descriptive and inferential statistical methods. The data is analyzed and interpreted using frequency distributions, measures of central tendency, and multiple bar charts for visual representation. Furthermore, a Chi-Square Test of Independence is performed to determine whether a statistically significant relationship exists between the age of children and the year they were immunized. The results from this analysis are discussed in line with the objectives of the study to provide meaningful insights and inform policy recommendations.

4.2 Data Analysis

Descriptive statistics

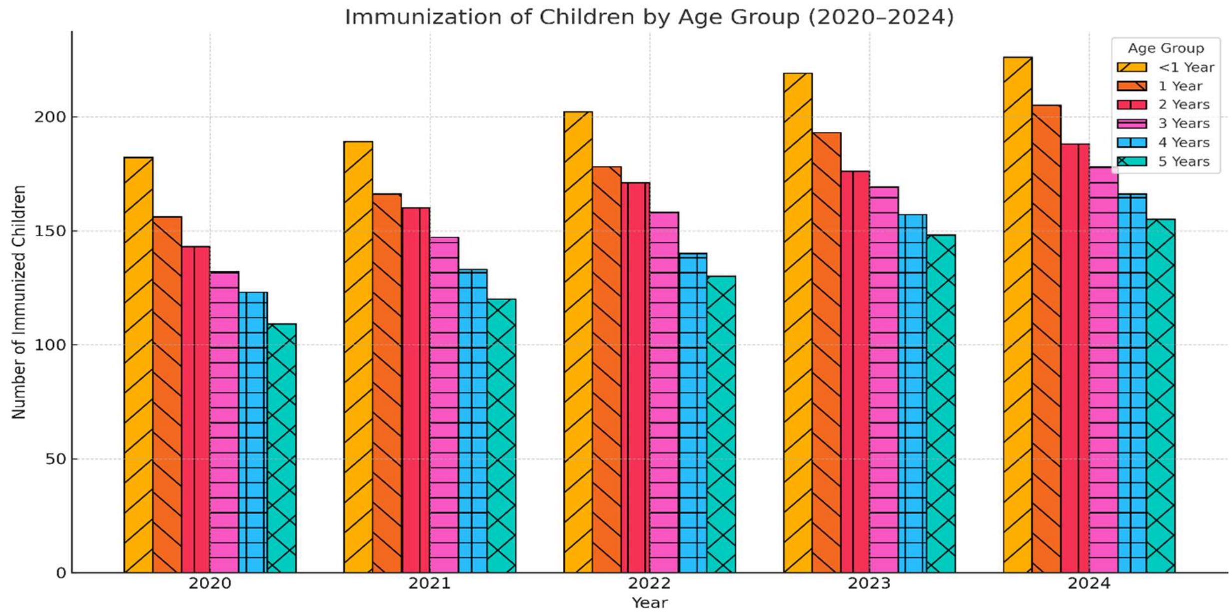
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Year	4919	2020	2024	2022.14	1.407
Frequency	4919	109	226	168.96	28.689
Valid N (listwise)	4919				

Interpretation:

The descriptive statistics show that a total of 4,919 children were immunized between 2020 and 2024. The number of children immunized increased each year, with the highest number in 2024 and the lowest in 2020. Children less than 1 year old were the most frequently immunized, while 5-year-olds were the least. This means most parents bring their babies for early vaccinations, but fewer return for older children's vaccines.

Visualization of the data (Multiple Bar chart)



Interpretation of Bar Chart

The bar chart clearly shows that immunization increased over the years for all age groups. The bars for each year get taller, especially for the <1 year (0 to 11 months old) group. This means that the health center improved its immunization efforts over time, and more children got vaccinated each year. It also shows that younger children get more attention than older ones in immunization programs.

Inferential statistics

Chi-Square Test (Year on Age)

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Year * Age	4919	100.0%	0	0.0%	4919	100.0%

Year * Age Crosstabulation

			Age						Total
			<1	1	2	3	4	5	
Year	2020	Count	182	156	143	132	123	109	845
		Expected Count	174.9	154.3	144.0	134.7	123.5	113.7	845.0
		% within Year	21.5%	18.5%	16.9%	15.6%	14.6%	12.9%	100.0%
		% within Age	17.9%	17.4%	17.1%	16.8%	17.1%	16.5%	17.2%
		% of Total	3.7%	3.2%	2.9%	2.7%	2.5%	2.2%	17.2%
	2021	Count	189	166	160	147	133	120	915
		Expected Count	189.4	167.0	155.9	145.8	133.7	123.1	915.0
		% within Year	20.7%	18.1%	17.5%	16.1%	14.5%	13.1%	100.0%
		% within Age	18.6%	18.5%	19.1%	18.8%	18.5%	18.1%	18.6%
		% of Total	3.8%	3.4%	3.3%	3.0%	2.7%	2.4%	18.6%
	2022	Count	202	178	171	158	140	130	979
		Expected Count	202.6	178.7	166.8	156.0	143.1	131.8	979.0
		% within Year	20.6%	18.2%	17.5%	16.1%	14.3%	13.3%	100.0%
		% within Age	19.8%	19.8%	20.4%	20.2%	19.5%	19.6%	19.9%
		% of Total	4.1%	3.6%	3.5%	3.2%	2.8%	2.6%	19.9%
	2023	Count	219	193	176	169	157	148	1062
		Expected Count	219.8	193.9	180.9	169.3	155.2	142.9	1062.0
		% within Year	20.6%	18.2%	16.6%	15.9%	14.8%	13.9%	100.0%
		% within Age	21.5%	21.5%	21.0%	21.6%	21.8%	22.4%	21.6%
		% of Total	4.5%	3.9%	3.6%	3.4%	3.2%	3.0%	21.6%
	2024	Count	226	205	188	178	166	155	1118
		Expected Count	231.4	204.1	190.5	178.2	163.4	150.5	1118.0
		% within Year	20.2%	18.3%	16.8%	15.9%	14.8%	13.9%	100.0%
		% within Age	22.2%	22.8%	22.4%	22.7%	23.1%	23.4%	22.7%
		% of Total	4.6%	4.2%	3.8%	3.6%	3.4%	3.2%	22.7%
Total		Count	1018	898	838	784	719	662	4919
		Expected Count	1018.0	898.0	838.0	784.0	719.0	662.0	4919.0
		% within Year	20.7%	18.3%	17.0%	15.9%	14.6%	13.5%	100.0%
		% within Age	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

	% of Total	20.7%	18.3%	17.0%	15.9%	14.6%	13.5%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.684[a]	20	1.000
Likelihood Ratio	1.681	20	1.000
N of Valid Cases	4919		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 113.72.

Crosstab Summary:

- Total number of valid cases: 4,919
- Each combination of Year × Age Group was presented with observed and expected counts.
- The expected counts were all above 5 (minimum = 113.72), fulfilling a key assumption of the Chi-Square test.

Chi-Square Test Interpretation:

The Pearson Chi-Square statistic is 1.684 with 20 degrees of freedom, and the associated p-value is 1.000, which is far greater than the typical significance level of 0.05.

Since, P-value (1.000) > Sig-Value (0.05), we fail to reject the null hypothesis.

This indicates that there is no statistically significant relationship between the age group and the year of immunization. In other words, the pattern of immunization across different age groups has remained statistically consistent over the five-year period (2020–2024) at the MPHCC Oke-Ose/Alalubosa facility.

Chi-Square test (Age on Year)

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age * Year	4919	100.0%	0	0.0%	4919	100.0%

Age * Year Crosstabulation

			Year					Total
			2020	2021	2022	2023	2024	
Age	<1	Count	182	189	202	219	226	1018
		Expected Count	174.9	189.4	202.6	219.8	231.4	1018.0
	1	Count	156	166	178	193	205	898
		Expected Count	154.3	167.0	178.7	193.9	204.1	898.0
	2	Count	143	160	171	176	188	838
		Expected Count	144.0	155.9	166.8	180.9	190.5	838.0
	3	Count	132	147	158	169	178	784
		Expected Count	134.7	145.8	156.0	169.3	178.2	784.0
	4	Count	123	133	140	157	166	719
		Expected Count	123.5	133.7	143.1	155.2	163.4	719.0
	5	Count	109	120	130	148	155	662
		Expected Count	113.7	123.1	131.8	142.9	150.5	662.0
Total		Count	845	915	979	1062	1118	4919
		Expected Count	845.0	915.0	979.0	1062.0	1118.0	4919.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.684[a]	20	1.000
Likelihood Ratio	1.681	20	1.000
N of Valid Cases	4919		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 113.72.

Chi-Square Test of Independence (Age vs. Year)

The Chi-Square test was used to check whether the number of children immunized in each age group depended on the year.

Conclusion: Since the p-value = 1.000, which is greater than 0.05, we fail to reject the null hypothesis. This means there is no statistically significant relationship between the age group and the year of immunization. So, while total immunization increased over the years, the distribution across different ages remained consistent. The health facility applied a stable immunization pattern yearly across all age brackets.

ANOVA

Descriptives

Frequency

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
2020	845	144.78	24.136	.830	143.15	146.41	109	182
2021	915	155.82	22.501	.744	154.36	157.28	120	189
2022	979	166.69	24.024	.768	165.19	168.20	130	202
2023	1062	180.13	24.243	.744	178.67	181.59	148	219
2024	1118	189.36	24.131	.722	187.95	190.78	155	226
Total	4919	168.96	28.689	.409	168.16	169.76	109	226

ANOVA

Frequency

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1254919.896	4	313729.974	552.000	.000
Within Groups	2792878.765	4914	568.351		
Total	4047798.661	4918			

From the descriptive stats:

- 2020 had the lowest mean (144.78)
- 2024 had the highest mean (189.36)

Therefore, immunization efforts have significantly improved each year, showing effective scaling of public health services at the MPHCC.

Interpretation: The ANOVA test was used to determine if there were significant differences in the average number of children immunized per year from 2020 to 2024. Because the p-value = 0.000, which is less than 0.05, we reject the null hypothesis. This means there is a statistically significant difference in immunization levels across different years.

Conclusion: There is a significant difference in the mean number of children immunized across the years 2020 to 2024**.** This confirms that the number of immunizations conducted annually significantly increased over the five-year period.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Summary of Findings

This study focused on analyzing the immunization trend of children aged 0 to 5 years at MPHCC Oke-Ose/Alalubosa, Ilorin East, Kwara State, from 2020 to 2024. The aim was to assess both the distribution of immunized children across age and year, and to statistically test for any significant differences or associations.

From the descriptive statistics, a total of 4,919 children were immunized during the period, with a mean frequency of 168.96 and a standard deviation **of** 28.689. Children less than 1 year of age consistently received the highest number of immunizations, while 5-year-olds had the lowest. The data showed a year-on-year increase in the total number of immunizations, indicating growing awareness and coverage.

The multiple bar chart visually confirmed that all age groups experienced increased immunization annually, with the most substantial growth seen in children below 1 year. This pattern highlights the health facility's strong focus on early childhood immunization.

The Chi-Square Test of Independence between age and year produced a Pearson Chi-Square value of 1.684 with 20 degrees of freedom and a p-value of 1.000**.** This result indicates that there is **no** statistically significant relationship between the age group of children and the year they were immunized. Thus, while the total number of children immunized increased annually, the pattern of immunization across the various age groups remained statistically consistent.

In contrast, the **ANOVA test** examining differences in immunization numbers across years yielded a significant result **(**$F = 552.000$, $p < 0.001$**)**. There is a significant difference in the mean number of children immunized across the years 2020 to 2024**.** This confirms that the number of immunizations conducted annually significantly increased over the five-year period.

5.2 Conclusion

The findings of this study conclude that MPHCC Oke-Ose/Alalubosa implemented a consistent age-based immunization strategy while significantly increasing the overall number of children immunized annually between 2020 and 2024. The consistency across age groups, as shown by the Chi-Square test, reflects the effectiveness of routine immunization programs that ensured all categories of eligible children were reached each year. Meanwhile, the significant increase in total immunizations as revealed by the ANOVA test reflects improved outreach, there is a significant difference in the mean number of children immunized across the years 2020 to 2024**.** This confirms that the number of immunizations conducted annually significantly increased over the five-year period.

5.3 Recommendations

Based on the findings, the following recommendations are suggested:

1. **Strengthen Efforts for Older Age Groups:** Children aged 4 to 5 consistently had the lowest immunization counts. More awareness campaigns should target these groups to ensure full immunization coverage across all eligible ages.

2. **Maintain Routine Consistency:** Since the age distribution of immunization has remained balanced over the years, this approach should be sustained to ensure no age group is underserved.

3. **Expand Data Monitoring:** A digital immunization registry should be introduced or improved to track vaccination status per child in real time and help identify defaulters.

4. **Government and Stakeholder Support:** Continued investment and support from government agencies and health partners should be encouraged to sustain and further improve immunization services.

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